

The Diversity of Makrozoobenthos as Bio-Indicators of Water Quality of the River Kundur District Labuhanbatu

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Abstract

Macrozoobenthos used as a bioindicator of the waters, this happens because of the nature of the benthos which has mpergerakan low so it got a lot of influence from the environment. This study aims to determine the condition of the river Kundur with a view the community structure of macrozoobenthos which include: species composition, abundance, diversity, uniformity and dominance as well as the physical and chemical parameters of water as a parameter supporters. Based on the results of observations, macrozoobenthos were found during the study in the river Kundur consists of 3 phylum, 4 classes, 17 family with 11 species. The composition of the class of macrozoobenthos in the whole of the observation station consists of a Gastropod (37%), Insecta (23%), Malacostraca (20%), Polychaeta (10%) dan Malacostraca (20%). The value of an abundance ranged from 325,7 - 3309,6 ind/m³. With the value of the total abundance at Station I which is equal to 3690,1 ind/m³, Station II 3723,1 ind/m³, Station III 3692,3 ind/m³ can be categorized diversity are light polluted with the value of the index of uniformity (E) that describes the spread of the individual tends to be uniform or relatively the same. While the condition of the physical-chemical parameters and the substrate bottom of the river Kundur in general has a range of relatively homogeneous, spread evenly throughout the observation stations and still be able to support life macrozoobenthos. To the results of measurements of the parameters of physico-chemical water and substrate in the river kundur in general has a range of relatively homogeneous in the whole observation stations and still be able to support the life of the macrozoobenthos.

Keywords

macrozoobenthos, the quality of the waters, Bio-Indicators



I. Introduction

The study of water quality can be done by various ways such as with the analysis of physical - chemical. For the waters of the dynamic, physico - chemical analysis of water gives an overview of the quality of the waters of real and can give deviations - deviations that are less favorable, because the range of values peubahnya very influenced by the circumstances of the moment. Dynamic environment, biological analysis, especially the analysis of the structure of the animal bentos can give a clear picture of the condition of the waters. Macrozoobenthos can change the organic material of large sized into smaller chunks so that the microbe is easy to decompose it (Izmiarti, 2010). Macrozoobenthos is an organism that lives on the bottom of the waters, and is part of the food chain, the existence of which relies on a population of organisms whose level is low (Noortiningsih and Handayani, 2008). River Kundur is the waters that many take advantage of the surrounding communities, such as fisheries, livestock and baths and other. A variety of such activities

can disrupt the balance of the waters, a Variety of aquatic ecosystems contained therein. It will also affect the condition of the biota of the inhabitants of the waters of the macrozoobenthos. This study aims to determine the condition of the river Kundur by looking at the diversity of macrozoobenthos which include: abundance, diversity, uniformity and dominance as well as physical - chemical parameters of water as a parameter supporters.

II. Research Methods

2.1 Time and Place

The research was conducted in the month of November until January 2021, located in the river Kundur, District Bilah Hulu Labuhanbatu province Sumatera Utara. Sampling was conducted at three research stations and nine replications at each station. On Satsiun 1. That is located at point $1^{\circ}57'47.67''N$ $99^{\circ}51'3.52''BT$, Station 2. Located at the point of $1^{\circ}57'51.62''N$ $99^{\circ}51'3.00''e$ and Station 3 is Located at point $1^{\circ}57'59.31''N$ $99^{\circ}51'0.85''BT$.



Figure 1. Location Research

2.2 Tools and Materials

Equipment used namely : Loop, Roll meter, Ice box, plastic Bag, sample Bottles, Sieve 5 x 5 mm 1 x 1 mm, Tweezers, digital Cameras, stationery, Shovel, GPS (Global Positioning System), DO Meter, the Materials used, namely Distilled water, Paper label, Tissue.

2.3 Sampling

The sampling method used in this research is purposive random sampling. Net surber used are size 25 cm x 40 cm comes with a mesh container. Surber placed facing the direction of current, then the sediment that is in the area of plot dredged and rubbed. This is done so that the macrozoobenthos and sediment can be accommodated in the net surber. Net surber subsequently lifted and the results of the sample are inserted into the plastic sample is labelled, with the given 70% alcohol. The results of the samples obtained were selected in order to facilitate in the identification process. The selection of samples is carried out in the Laboratory and subsequently identified.

III. Results and Discussion

3.1 The Parameters of The Physics - Chemical

The conditions of physical-chemical parameters of the waters in the river kundur can be seen on the measurement condition parameters measured, the physical-chemical parameters measured were temperature, turbidity, current velocity, salinity, pH, dissolved oxygen.

Table 1. The Results of the Average Parameters of the Physics-Chemistry Waters

| Parameter | Station | Measurement Results |
|------------------|---------|---------------------|
| Temperature (°C) | I | 26,35 |
| | II | 26, 57 |
| | III | 26,72 |
| pH | I | 6 |
| | II | 6,5 |
| | III | 7 |
| DO (mg/l) | I | 7,74 |
| | II | 7,3 |
| | III | 8,18 |

Source: Primary Data

The average results of the temperature measurement on the Island Lengkang range 26,35 - 26,72 oC. The temperature value on to three such stations are relatively similar and did not show any significant differences. This is because the state of the weather at the time of measurement at relatively the same so that the temperature does not change or fluctuation. In general, the temperature range obtained during the research is the range that can still support the life of the macrozoobenthos.

The results of the measurement of the Degree of Acidity (pH) on to the three research stations showed no differences in pH values at each station, which amounted to 6.5 which means the waters are acidic and natural. According to Oktarina and Syamsudin (2015) that a group of organisms makrozoobenthos can generally adapt well in the aquatic environment that has a range of pH values around 7 (neutral). Thus the terms of the pH value, then the flow of the river Bar is a suitable habitat for the development of various types of makrozoobenthos

The pH value of the measurement result does not have a difference that is equal to 6, it is suspected because of the accuracy of the tool is low. The average results of measurements of dissolved oxygen (DO) ranged from 7.3 to 8,18 mg/l. Naturally precipitation has a pH value as low as about 5.0 (Barus, 2004). The pH value obtained from the three research stations still life support and development macrobenthos (Harahap, A 2018).

A pH value normal indicates that the amount of dissolved organic matter is small. Analysis of the type of the substrate at each sampling point at each station observations obtained type of the substrate, i.e. at Station I (sand, sand gravel and sandy gravel), Station II (sand, silt sandy), Station III (sand, sandy gravel).

Based on the above table the average overall type of macrozoobenthos were found on the island of lengkang namely on the sand substrate but also there are some that are contained in the substrate of sandy gravel, sand gravel and silt sandy. But the substrate is the most populated macrozoobenthos namely a sand substrate. According to the Handayani et al. (2000), Gastropods is an organism that has spread widely in the substrate is rocky,

sandy and muddy but these organisms tend to like the base substrate of sand and a little muddy.

3.2 The Community Structure of Macrozoobenthos

Based on the results of observations, macrozoobenthos were found during the study in the river Kundur Kecamatan belakang Padang Batam City, Riau Islands Province, which consists of 3 Phyla, 5 Classes, 17 Families with 19 Species.

Table 2. Types of Macrozoobenthos were Found in the River Kundur

| Phylum | Class | Family | Species | |
|------------|--------------|---------------|---------------------------|------------|
| Moluska | Gastropoda | Pleuroceridae | <i>Pleurocera</i> sp. | |
| | | Pleuroceridae | <i>Goniobasis</i> sp. | |
| | Insecta | Diptera | Chironomidae | |
| | | | Odonata | Aeshinidae |
| | | Diptera | Gomphidae | |
| | | | Chironomidae | |
| Arthropoda | Malacostraca | Portunidae | <i>Portunus pelagicus</i> | |
| | | Ocypodidae | <i>Ocypode</i> sp | |
| | | | <i>Uca</i> sp | |
| Anelida | Polychaeta | Nereididae | <i>Nereis</i> sp | |

The composition of the class of macrozoobenthos in the whole of the observation station consists of a Gastropod (37%), Insect (23%), Malacostraca (20%), Polychaeta (10%) and Malacostraca (20%). The composition of the class that most mendominasi is the Gastropods and Bivalves. According to the Handayani et al.,(2000) Gastropods is an organism that has spread widely in the substrate is rocky, sandy and muddy but these organisms tend to like the base substrate of sand and a little muddy.

The results of the calculation of the value of the abundance of individuals in the four research stations ranged between 325,7 - 3309,6 ind/m³. With the value of the total abundance at Station I which is equal to 3690,1 ind/m³, Station II 3723,1 ind/m³, Station III 3692,3 ind/m³ while in the. Of the three stations the station II has a value of abundance is high, it is thought to organic content of the substrate is as high as the one of the food sources and factors of chemical physics waters is better than other stations.

Cummins (1975) in Efrizal (2008) stated that the distribution and abundance of macrozoobenthos depends on several factors such as quality and quantity of food, the ability of the organism adjust to the physical and chemical parameters of the waters. While the value of an abundance of lowest at Station III, the low values of abundance at this station due to the location of the station that the open sea was allegedly the content of organic material in the station is low which leads to reduced abundance of macrozoobenthos.

The results of the calculation of the value of the index of diversity (H') on the fourth research station ranged from 1.75 to 1.78 to. The value of the index of diversity (H') was highest at Station II which of 1.95. The high index of diversity in Station II shows the environmental conditions of the river kundur good, and support the life of the biota in it. It can also be seen from the high dissolved oxygen levels at this station so that the consumption of O₂ is available for biota in it. In addition, at the station this species is found with the number of individuals among the species tend to be more balanced. The

value of the diversity index of the most low there at Station III, namely by 1.74. The level of diversity that low shows that the deployment of individuals of each type tend to be uneven and the condition of the stability of the community tend to be low.

This is due to the smaller number of species and the presence of some individuals who are more numerous resulted in an imbalance of the ecosystem which is likely due to the pressure of the ecological or interference from the surrounding environment. Diversity includes two important issues, namely the number of types in a community and the abundance of each type, so the smaller the number of types and variations of the number of individuals of each type have a deployment that is not evenly, then diversity will shrink (Odum, 1993). According to Sastrawijaya (2000) classification of the degree of water pollution based on the diversity index can be classified as follows:

$H' < 1.0$: The Heavily Polluted

$H' = 1,0-1,6$: Medium Polluted

$H' = 1,6-2,0$: Light Polluted

$H' > 2,0$: Not Polluted

The high index of diversity in station 1 is suspected because the substrate is essentially in the form of muddy sand smooth and the presence of rock that supports the life of the macrozoobenthos. And the absence of community activities that take place at station 1. According to the Sahri et al., (2000) substrate muddy smooth and the rock is the habitat of the most good for the macrozoobenthos to get food, shelter from the currents and attach themselves while the substrate is gravel with sand is very easy to get carried away by the current of the water making it difficult for macrozoobenthos to attach themselves or settle on the substrate.

Based on the Diversity Index Shannon Wiener (H') according to Lee et al (1975) in Fachrul (2007) the river Kundur can be categorized as light polluted where the index value their diversity are with the value of the index of 1.85 - 1,93. Such conditions are suspected presence of pressure ecology derived from the activity around the waters of the density of settlements on the Island Lenggang where the household waste which is produced organic waste and inorganic waste that can affect the contribution of the index value the diversity of macrozoobenthos on the location of the waters.

Table 3. The Index Value of Diversity (H'), Uniformity (E) And Dominance (C) at the Macrozoobenthic Research Station

| Index | Station | | |
|--------------------|---------|------|------|
| | I | II | III |
| Diversity (H') | 1,75 | 1,95 | 1,76 |
| Uniformity (E) | 0,98 | 0,92 | 0,93 |

Source: Primary Data

The value of the Index of Uniformity (E) obtained at the fourth research station ranged from 0.93 to 0.98 in. The Uniformity of the highest in Station II of the 0.90 and the lowest at Station III of 0.93. According to Brower et al (1990) in Wijayanti (2007) the category of the value of uniformity a population will range from 0 - 1 with the criteria : $E > 0.6$ a high uniformity; the $0.4 < E < 0.6$ to the uniformity of the medium; $E < 0,4$ uniformity is low.

Based on the value of The Uniformity in the river Kundur on four research stations generally demonstrated the value of high uniformity. In other words, these values illustrate that the spread of the individual tends to be uniform or relatively the same. According to Krebs (1985) the value of the Index of Uniformity (E) ranged between 0-1. If the value of the uniformity of close to 0 means uniformity low because there are types that dominate.

When is close to 1, then the high uniformity and describe there is no type that dominates so that the distribution of the number of individuals in each type of very uniform or evenly. The value of the uniformity in the river bar Rantauprapat on five research stations generally show the value of uniformity is almost close to the maximum value in other words the spread of the population of macrozoobenthos is quite good, as indicated by the many types of macrozoobenthos were found at each station, although at a particular station happened pependominasian a certain type. This may be related with the state of the waters or the type of substrate that may be less supportive of the population.

IV. Conclusion

Based on the results of observations, macrozoobenthos were found during the study in the river Kundur consists of 3 Phyla, 4 Classes, 17 Family with 11 Species, namely with the composition of the Composition class of macrozoobenthos in the whole of the observation station consists of a Gastropod (37%), Insect (23%), Malacostraca (20%), Polychaeta (10%) and Malacostraca (20%). The value of an abundance ranged from 325,7 - 3309,6 ind/m³. With the value of the total abundance at Station I which is equal to 3690,1 ind/m³, Station II 3723,1 ind/m³, Station III 3692,3 ind/m³ can be categorized diversity are light polluted. with the value of the index of uniformity (E) that describes the spread of the individual tends to be uniform or relatively the same. While the condition of the physical-chemical parameters and the substrate bottom of the river Kundur in general has a range of relatively homogeneous, spread evenly throughout the observation stations and still be able to support the life of macrozoobenthos to live and reproduce.

References

- Barnes, R. D. 1980. Invertebrate Zoology. Fifth Edition. Saunders College Publishing.
- Barus, T.A. 2004. Pengantar Limnologi. Studi Tentang Ekosistem Air Daratan. Penerbit USU Press.
- Efrizal, T. 2008. Struktur Komunitas Makrozoobentos Perairan Sungai Sail Kota Penkanbaru. Journal of Environment Science. Universitas Riau.
- Fachrul, M. F. 2007. Metode Sampling Bioekologi. Bumi Aksara. Jakarta.
- Ghufran. M. H. Kordi. K, Andi Basong Tancung. 2007. Pengelolaan Kualitas Air Dalam Budidaya Perairan. Penerbit Rineka Cipta. Jakarta.
- Hutabarat, S dan S. M. Evans, 1985. Pengantar Oseanografi. Universitas Indonesia. Jakarta.
- Handayani S dan ISL Tobing. Keanekaragaman fitoplankton di perairan pantai sekitar Merak – Banten dan pantai Penet – Lampung. VIS VITALIS, Jurnal Ilmiah Biologi 01 (1) : 29-33, 2008.
- Harahap, A. dkk. 2018. IOP Conf. Series: Journal of Physics: Conf. Series 1116 (2018) 052026
- Izmiarti. 2010. Komunitas Makrozoobentos di Banda Bakali Kota Padang. Jurnal Biospectrum 6 (1). 34-40

- Odum, E. P. 1993. Dasar-dasar Ekologi. Diterjemahkan Oleh T. Samingan. Gadjah Mada University Press. Yogyakarta.
- Prihatiningsih, 2004. Struktur Komunitas Makrozoobentos di Perairan Teluk Jakarta. Skripsi Institut Pertanian Bogor. Bogor (tidak diterbitkan).
- Sastrawijaya, A. T. 2000. Pencemaran Lingkungan. Edisi Kedua. Rineka Cipta. Jakarta.
- Wijayanti, M. H. 2007. Kajian Kualitas Perairan di Pantai Kota Bandar Lampung Berdasarkan Komunitas Hewan Makroobentos. Tesis Universitas Diponegoro. Semarang.